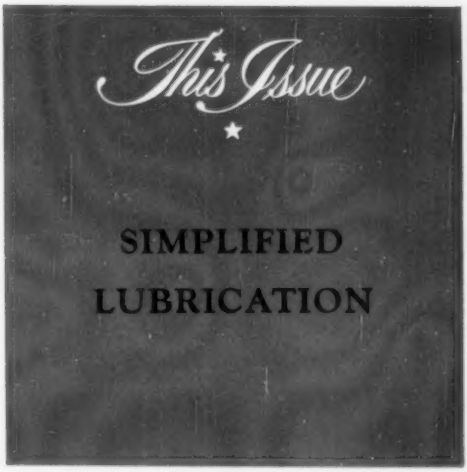
Volume 47 JUNE, 1961 Number 6

Lubrication

A Technical Publication Devoted to the Selection and Use of Lubricants



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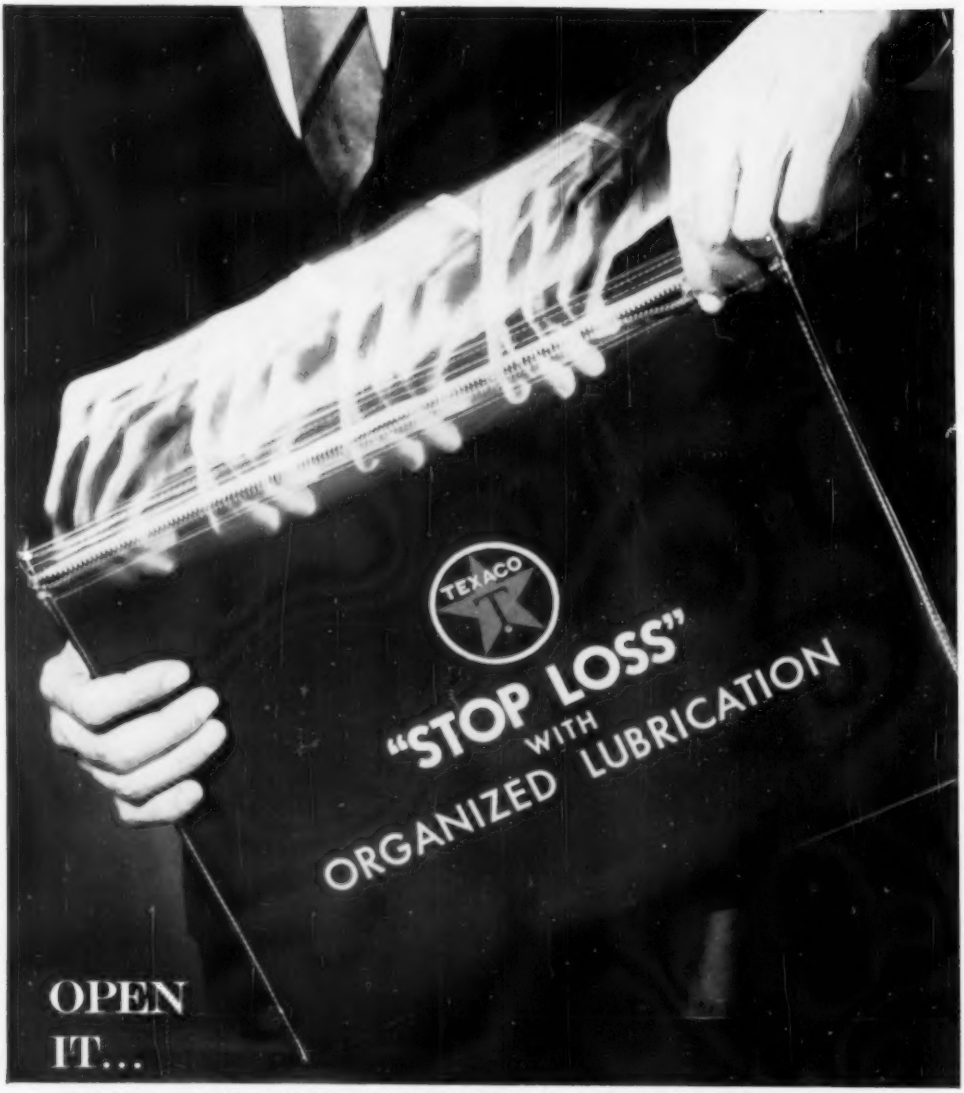

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LUBRICATION

A TECHNICAL PUBLICATION DEVOTED TO THE SELECTION AND USE OF LUBRICANTS

Published by

Texaco Inc., 135 East 42nd Street, New York 17, N. Y.

Vol. XLVII June, 1961 No. 6

Change of Address: In reporting change of address please give both old and new addresses.

SIMPLIFIED LUBRICATION

WHAT does Simplified Lubrication mean? The dictionary defines Simplified as, "to make simpler; to show an easier or shorter process for doing, etc.—". Lubrication is defined as, "act of lubricating, or state of being lubricated." In a nutshell, Simplified Lubrication is a shorter, easier, process of lubricating. In industry, a shorter, easier process usually means money saved.

It has been estimated that man as a thinking individual has existed between 25 and 30 thousand years. He has utilized lubricants, however, for only the latter third of this period. Man's initial attempts at lubrication were undoubtedly quite simple: use of mud on an inclined plane; animal fat on the axles of the primitive wheel; animal and vegetable oils on crude implements of war such as the catapult and hinged portions of body armor. For thousands of years, the equipment was simple and in like manner, the lubricants were simple.

With the onset of the Industrial Revolution, machinery started to become more complicated and more demanding of lubricants. Animal and vegetable oils and fats were able to cope with these increased requirements for awhile, but the problem became increasingly difficult until the advent of petroleum products in the middle of the 19th Century. For the next 60 years, most of industry's requirements for lubricants were met with a comparatively few types of products and lubrication was still essentially simple.

Following World War I, industry began its tremendous expansion which is still in effect today. Ever increasing power, greater precision, higher speeds, increased emphasis on reliability, more specialization of equipment all placed more and more pressure on lubricant suppliers to provide adequate products. Petroleum research and development have consistently met the challenge as witnessed by our highly mechanized society.

In the process of machine development and corresponding lubricant development, the lubricant availability picture has changed drastically from a few products for a great many applications to a great many products for a few specialized applications. There are several reasons why this has come about. As a manufacturer brought an improved machine on the market it would not operate satisfactorily on the lubricants available; hence a new lubricant had to be developed. Frequently, the manufacturer would specify this new product since he knew that his machine would operate satisfactorily with it. He would continue, however, to recommend the older lubricants for the older line of machines which he manufactured. If this happened twice more in five years and each model required two different types of oil and one grease, he would end up with recommendations for six different types of oils and three different types of greases for a total of nine distinct products for just the more recent machines in his line.

A purchaser of the previously cited manufacturer's line over this five-year period would need nine lubricants if he followed the manufacturer's recommendations. If this purchaser also bought similar equipment from two other manufacturers, he could conceivably be saddled with 27 different special lubricants. This sort of thing does not need to happen too many times before he has an oil house crammed full of assorted products.

There are many additional reasons why many types and grades of lubricants may be stocked; however, little can be gained by examining each one in detail. What then, are the objections to this multiplicity of products?

Probably the major objection to multiple stocking is the greatly increased chance of misapplication. The application of a straight mineral oil to a unit requiring an extreme pressure product can, and often does, result in equipment failure and resultant shut-down. Misapplication is usually non-intentional and due to confusion or ignorance, but the end result is the same—shutdown of the equipment and possibly of the whole plant if the machine is in a critical position in the production line.

Multiple stocking also means larger inventories. Larger inventories tie up operating capital.

Multiple stocking requires additional inventory control. This generally means that more manpower must be assigned to insure that the large variety of products are neither overstocked nor understocked, nor stored so long as to deteriorate or become contaminated.

Stocking a large variety of products almost always requires a larger oil house or drum shed. This can be particularly costly where unit area building prices are high.

Duplication and maintenance of lubrication equipment such as grease guns, oil pumps and dispensers, tankage, oil cans, etc., required for each of a variety of products can be a sizable investment item.

Assuming equal consumption, it is usually more expensive to purchase 15 drums each of three different products than 45 drums of just one.

How can simplified lubrication be effected? The problem can be approached from three directions:

1. From the equipment manufacturer's side.
2. From the equipment users' side.
3. From the lubricant manufacturer's side.

EQUIPMENT MANUFACTURERS

Equipment manufacturers can have a most important influence in achieving simplified lubrication. During the design of a new piece of equipment the avoidance of a critical design from the standpoint of metallurgy or unit loading can go a long way toward eliminating the need for a special lubricant. Failure to provide adequate cooling will frequently place an extra load on the equipment and its lubricant, necessitating a special lubricant to overcome the design deficiency. Over-rating the capacities of an existing line of machines will often make them critical of the existing lubricant. Usually a special product will have to be provided to make the over-rated machine operate satisfactorily. Poor sealing of a gearset will prevent it from retaining a fluid lubricant. This necessitates the use of a grease-type product with special characteristics, namely fluid enough to flow over and lubricate the gear surfaces but not fluid enough to leak out of the gearcase. There are many other instances that can be cited. The important consideration, however, is that equipment manufacturers must give adequate consideration to the lubrication of their equipment while it is still in the design stage and can be corrected.

EQUIPMENT USERS

When a concern purchases a new piece of equipment, it may be accompanied by any of a number of types of lubrication instructions. For example, the equipment manufacturer may recommend lubricants by specific brand names either by a plate affixed to the machine or in the operating manual accompanying it. The manufacturer may not recommend by brand name but may specify the characteristics required of the lubricants for machines of his manufacture. Sometimes these specifications will be very restrictive and will be met by only one lubricant manufacturer. Other times, they will be very general and allow considerable leeway as to the choice of lubricant and its marketer. Almost invariably, however, the warranty furnished by the equipment manufacturer will be honored only if the purchaser adheres to the lubricants recommended by the manufacturer. At the end of the warranty period, the purchaser is free to use whatever lubricant he wishes. At this point, the purchaser must make the decision as to whether to continue using the manufacturer's recommended products or whether to integrate the lubricant requirements of his machine with those he already has in his plant. This decision, which must be made every time a new piece of equipment is put into service, may determine whether the plant is lubricated with 8 products or 28.

Selecting petroleum products on the basis of price alone is one of the poorest economies that the equipment user can make. Take the case of two similar hydraulic presses, one of somewhat older vintage but in reasonably good condition, the other one comparatively new. The shop will put a straight mineral oil in the older unit and a premium grade rust and oxidation inhibited oil in the newer model. Not only does this require stocking two products for make-up, but it denies the benefits of rust inhibition, longer oil life and better operation to the older unit. Just the cost of "changing out" the oil in the older unit several times will far ex-

ceed the small additional cost of initially installing a long-lived premium grade rust and oxidation inhibited oil. In fact, the cost differential is probably only a few cents per gallon. The selection of premium grade lubricants will not only assist in reducing inventory, but will usually more than repay the small price differential by increased performance.

One of the most difficult problems to overcome in simplifying the lubrication practices of a plant is the natural resistance of plant personnel to any change. A machinist may have been lubricating his particular unit with a heavy bodied red oil for years. If he is supplied an oil that is slightly lighter in body and color, he may resist or refuse to use it on the basis that he had used the previous oil on his machine for years and never had any problem with it. Even a section foreman or a department manager may have the same attitude. Despite the fact that the new oil, chosen for simplification purposes, will work as well or better, the change will be resisted. If widespread, such attitudes can easily defeat a simplification plan and thereby cost the plant a possible savings of thousands of dollars per year. Education of the personnel involved, prior to the change, is one of the most effective means of avoiding this pitfall. When people are advised beforehand of the plan in mind, and kept informed, they will feel that they took part in the operation and will usually extend themselves to make the new system work.

LUBRICANT MANUFACTURERS

Every lubricant manufacturer would like to develop a "universal lubricant" which could lubricate every piece of equipment in existence. While it is doubtful that this ideal will ever be achieved, much progress has been made in developing lubricants which are more versatile and capable of broader application. The widespread use of multi-grade SAE 10W-30 motor oil is a good example: It can now be stocked for automotive gasoline engine crankcases and used in place of the three single grades—SAE 10W, SAE 20-20W, and SAE 30. One multi-purpose automotive grease now replaces three automotive greases—a chassis lubricant, a water pump grease and a wheel bearing lubricant. In the metal forming industry the triple-purpose oil which functions as a cutting oil, as a machine tool lubricant and as an hydraulic oil has supplanted the three single-purpose oils which were formerly required for these purposes. Triple-purpose oil has also helped reduce overall consumption since leakage from the hydraulic or lubricating systems on a machine does not reduce the extreme pressure characteristics of the cutting fluid and thereby require frequent replacement.

Several other examples could be cited. However, it can be generally stated that the petroleum industry is continually exploring the possibilities of making additional multi-purpose products available to industry.

HOW TO SIMPLIFY

Satisfactory lubrication has been defined as comprising all of six rights: the *right* type and *right* quality of lubricant, in the *right* amount and *right* condition, in the *right* place, at the *right* time. Since this article deals with simplification which is accomplished by reducing the number of lubricants required in an existing plant or location it may be assumed that the right amount, condition, place, and time have already been provided by good lubrication and storage procedures. The two remaining rights—right type and right quality—can be assured through careful consideration of factors such as those discussed below.

The prime requirement of a lubricant is that it minimize friction in the unit to which it is applied. In line with this requirement, it must also keep wear of the unit down to an acceptable figure. Following these prime requirements other factors will enter the picture such as viscosity, viscosity index, pour point, extreme pressure properties, oxidation inhibitors, rust inhibitors, detergent-dispersant additives, etc. With a grease, consideration must also be given to soap base, consistency, dropping point, pumpability, etc.

Viscosity

Viscosity is an oil's most important single property, and is the characteristic most frequently used in specifying an oil. Viscosity can be specified as Kinematic, as Saybolt Universal Seconds (SUS), as Saybolt Furol Seconds, as Engler Degrees, or as Redwood No. 1 or No. 2 Seconds.[1] Various systems have also been devised to specify viscosity ranges such as the SAE[2] and AGMA[3] given in Tables 1, 2 and 3.

A common misconception about specifying an oil by means of a single viscosity is that the product offered against the specification must meet the viscosity exactly. For example, if the specification is 300 SUS at 100°F., and a product is offered with a viscosity of 325 SUS at 100°F., it is rejected. The truth of the matter is that most machinery cannot distinguish that closely at this viscosity level and products of 260 or a 340 SUS at 100°F. could be readily accepted. Going one step, further, if an equipment user has two machines, one calling for an oil of 300 SUS at 100°F. viscosity and the second for the same type oil with a viscosity of 400 SUS at 100°F., he could most probably use the 400 viscosity oil in both machines thereby eliminating one viscosity grade.

[1] For details on measurement and conversion among viscosities see Lubrication Magazine for January and February 1961.
[2] Society of Automotive Engineers.
[3] American Gear Manufacturers Association.

TABLE 1

SAE MOTOR OIL VISCOSITY GRADE CLASSIFICATION SYSTEM

SAE VISCOSITY GRADE NUMBER	VISCOSITY, SAYBOLT UNIVERSAL SECONDS			
	AT 0 DEGREES F.		AT 210 DEGREES F.	
	MINIMUM	MAXIMUM	MINIMUM	MAXIMUM
5W		4,000	39	
10W	6,000	12,000		
or		12,000	40	
20W	12,000	48,000		
or		48,000	45	
20			45	58
30			58	70
40			70	85
50			85	110

Viscosity Index

Viscosity Index (VI) is a measure of the change of viscosity with change in temperature and will be significant only where large temperature changes are encountered with a unit. The higher the V.I., the less the change of viscosity due to temperature that will be encountered. Normally, V.I. need not be considered for simplification purposes.

Gravity

API Gravity of lubricating oils will be of significance only where seals are concerned. Oils with an API Gravity less than 22 are usually naphthenic in nature, while those above 27 are paraffinic. If a hydraulic system containing a naphthenic oil is switched over to a paraffinic oil, the possibility of seal shrinkage and consequent leakage exists. Conversely, a switch from paraffinic to naphthenic could cause seal swelling resulting in seal glazing or erratic piston movement on smaller units. Other than with seals, gravity does not play an important factor in simplification purposes.

Pour Point

The pour point of an oil must obviously be below the lowest temperature anticipated in service, if it must flow into the mechanism to be lubricated.

Extreme Pressure Properties

Most requirements for a lubricating oil with extreme pressure (EP) properties stem from heavily loaded gears. There are two general types of EP gear oils—mild EP and active EP. The mild EP, which is generally a lead naphthenate type, is widely used in industrial gearing and less frequently in automotive gears. The active EP type is in general use in automotive gearing and to a lesser extent in industrial gearing.

The mild EP gear oils are generally non-corrosive to copper alloys throughout their effective working temperature range, but cannot carry as heavy a load as the active EP types. The active EP types, because of their chemical make-up, may attack some copper alloys at elevated temperatures or under very heavy unit loading. In general, if an industrial plant has a

TABLE 2

VISCOSITY RANGE OF AGMA STANDARD 250.02 DECEMBER 1955 SPECIFICATION LUBRICATION OF INDUSTRIAL ENCLOSED GEARING

AGMA LUBRICANT NUMBER	VISCOSITY RANGE, SAYBOLT UNIVERSAL SECONDS	
	AT 100 DEGREES F.	AT 210 DEGREES F.
1	180 to 240	
2	280 to 360	
3	490 to 700	
4	700 to 1000	
5		80 to 105
6		105 to 125
7 comp.*		125 to 150
8 comp.*		150 to 190
8A comp.*		190 to 250

*The oils marked "comp." are those compounded with 3 to 10 percent of acidless tallow or other suitable animal fats.

TABLE 3

VISCOSITY RANGE OF TENTATIVE AGMA STANDARD 252.01 MAY 1959 SPECIFICATION MILD EXTREME PRESSURE LUBRICANTS FOR INDUSTRIAL ENCLOSED GEARING

AGMA MILD EP LUBRICANT NUMBER	VISCOSITY RANGE, SAYBOLT UNIVERSAL SECONDS	
	AT 100 DEGREES F.	AT 210 DEGREES F.
2 EP	280- 400	
3 EP	400- 700	
4 EP	700-1000	
5 EP		80-105
6 EP		105-125
7 EP		125-150
8 EP		150-190

group of gearsets, part of which use conventional lubricating oils, and part of which require a mild EP gear oil, it is entirely feasible to lubricate all of them with the proper quality of mild EP oil.

Active EP gear oils have been and are being used in industrial gearsets and the same simplification procedure cited above can be employed. The only precaution to be taken would be to ascertain if some of the gears in the sets could be subject to corrosion under the conditions at which they will operate.

Rust and Oxidation Inhibitors

While the use of effective rust and oxidation (R&O) inhibitors may slightly increase the price of an oil, this is more than offset by the greatly increased protection they afford.

Detergent-Dispersant Additives

Detergent-Dispersant additives are usually associated with internal combustion engine oils. Oils containing these additives are generally referred to as heavy duty oils and have become almost universally accepted. There are three generally accepted levels of heavy duty oils available: the MIL 2104, the Supplement 1, and the Series 3 which are listed in order of ascending duty level and increasing protection against sludge, ring sticking, rust and corrosive wear.

In simplified lubrication practice, a truck fleet operator might require a Supplement 1 oil for a portion of his fleet; the remainder would require a MIL 2104 oil. For simplification purposes, a Supplement 1 oil would be used for the entire fleet, thereby decreasing stocking and confusion. The same philosophy would hold true in the case of a construction company, a portion of whose equipment would require a Series 3 oil.

Greases

Where a general purpose grease is called for in equipment, the job can usually be filled by a multipurpose lithium or calcium soap base grease. It is only when portions of a unit or several individual units require a more specialized product that consideration should be given to simplification.

On automotive equipment for example, three greases are frequently required: a No. 2 grade wheel bearing grease, a No. 0 or 1 chassis grease, and a water pump grease. Since the wheel bearing grease is the dominant factor, it would be chosen and also used for the chassis and the water pump. This can be done provided the grease has satisfactory pumpability characteristics to be used as a chassis grease and is sufficiently water resistant for use in the water pump. Modern high quality multi-purpose greases have these capabilities.

In an industrial plant, there is frequently a requirement for a No. 2 extreme pressure grease for several critical applications, a No. 2 general purpose grease and a No. 1 cup grease. These three types of greases can be consolidated and the entire plant lubricated with a No. 2 EP grease of proper quality. Not only is the stocking and application problem simplified but the non-critical applications also gain additional protection.

SIMPLIFICATION PROCEDURE

When simplifying the lubricants used in a plant, the requirements of each unit should be set down on paper in terms of the general type of lubricant (oil, grease or gear compound). Under each type, the properties of each product should be grouped such as oil viscosity, detergent-dispersant requirements, EP requirement, rust and oxidation inhibition, NLGI[4] grade of grease, viscosity of oil component in the grease, pumpability, EP characteristics, etc.

At this stage, viscosity groupings can be made. For instance, if three otherwise similar oils have viscosities of 110, 150 and 190 SUS @ 100°F., the final oil selected should have a viscosity of about 150 SUS @ 100°F. If one of the original oils was R&O inhibited, the final product should be also. A

[4] National Lubricating Grease Institute.

second group of oils with viscosities @ 100°F. of 280, 330 and 350 SUS could be reduced to one oil having a viscosity in the neighborhood of 315 SUS @ 100°F. In each group of oils selected, consideration should be given to the most severe requirement of any of the original oils and the consolidated oil required to have this same characteristic to at least the same degree. The same procedure would hold true for greases.

The one precaution to keep in mind is that there may be a few critical applications which require a very specialized lubricant. These should be set aside and not consolidated into the simplified plan until such time as carefully supervised tests have shown that the critical application can be successfully incorporated into the plan.

Simplified plans have already been prepared for several major industries, examples of which are shown in Tables 4, 5 and 6.[5] Lubricant symbols are explained and described in Table 8.

TABLE 4

SIMPLIFIED LUBRICATION CHART FOR INDUSTRIAL TRUCKS

Engine Crankcase Bearings—Oil Lubricated	S-3
Gear Units (transmissions, differentials, power axle, steering gear, lift or tilt gears), Oil Lubricated Universal Joints	GL-4 or WL
Chassis Grease Fittings, Upright or telescopic slides, controllers (electric trucks), Wheel Bearings, Universal Joints	WB
Hydraulic Systems	HO
Exposed Gears and Chains	GC

Table 7 presents an example of a job lot machine shop which had expanded over a period of years. The column headed "Lubricant Specifications" shows the equipment manufacturer's recommendation for each unit. The "Simplified Plan" column shows the lubricant in use after simplification. The shop was using 28 separate products to lubricate its equipment. This was reduced to 7 products by simplification. Performance of the equipment was entirely satisfactory with the simplified products and in several instances far superior than with the previously used lubricants.

TABLE 5

SIMPLIFIED LUBRICATION CHART FOR MACHINE TOOLS

Hydraulic System General Machine Lubrication	HG
Gears	WL
Spindles	SP
Ways	WY
General Grease	WB

[5] For additional Industry Simplification Plans, see Lubrication Magazine: Dec. 1959, Printing Lubrication; May 1960, Bus & Truck Lubrication; June 1960, Dairy Industry; March 1961, Farm Mechanization; May 1961, Douglas Fir Plywood.

TABLE 6

SIMPLIFIED LUBRICATION CHART FOR LARGE CONSTRUCTION PROJECTS

Engines (Gasoline, LPG, and Diesel) Engine Accessories—Oil Lubricated Bearings—Oil Lubricated	S-3
Gear Boxes Chain Drives Flexible Couplings Universal Joints Other Oil Lubricated Parts in Heavy Duty Service	GL-4 or WL
Hydraulic Mechanisms Air Compressors Electric Motors and Generators	HO
Grease Fittings Plain Bearings Ball or Roller Bearings Wheel Bearings Other Hand Packed Bearings	WB
Track Rollers	RL
Exposed Gears Wire Ropes and Cables	GC

There are many cases on record where simplification has dramatically reduced a manufacturer's lubricant inventory. One midwest manufacturer was purchasing lubricants in conformance to recommendations from about everyone in the plant—from the machine operators up to departmental managers. A survey of the plant plus simplification reduced the number of lubricants purchased from 97 to 20.

A prominent national rubber goods manufacturer's plant has been surveyed and his lubricant stock reduced from 36 products to 21, including all viscosity grades.

One major manufacturer determined that it cost him 3 dollars to initiate a purchase order. He placed 1200 orders per year in order to maintain an inventory of 100 different lubricants for his plant. Following simplification to 20 products and by ordering these products quarterly, his ordering cost alone was reduced from $3,600. to $240. per year for a saving of $3,360. per year. This saving was just his internal ordering cost and does not include the many other economies realized.

TABLE 7

EQUIPMENT	LUBRICANT SPECIFICATIONS	SIMPLIFIED PLAN
Heavy Duty Grinders		
Oil lubrication points		
Model 310	SAE 10 oil	HO
Model 415	SAE 20 oil	HO
Rotary Air Compressor		
Electric Motor	SAE 10 oil	HO
Compressor Circulating Oil System	150 SUS @ 100°F. R&O oil	HO
High Speed Drilling Machine		
Circulating System	390 SUS @ 100°F. R&O oil	HG
Motor Bearings	No. 2 Sodium base grease	WB
Hydraulic System	300 SUS @ 100°F. compounded oil	HG
Automatic Lathes		
Oil lubrication points	275 SUS @ 100°F. highly refined oil	HG
Apron gears & bearings, bedways, slideways	Special EP non-corrossive 325 SUS @ 100°F. way oil	WY
Motor Bearings	No. 2 lithium base grease	WB
Plant Passenger Cars		
Engine	Supplement 1 Motor Oil SAE 10W-30	MS
Transmission, steering gear, differential	MIL-002105A gear lubricant	GL-4
Chassis Grease Points	Good grade of chassis grease	WB
Wheel Bearings	Good grade of wheel bearing grease	WB
Plate Bending Rolls		
Grease Points	No. 1 Calcium soap grease	WB
Reduction Gears	AGMA No. 5 oil	GL-4
Fork Lift Trucks		
Engine Crankcase	XYZ Co.'s MIL-2104 Oil	
Above 90°F.	SAE 30	MS
90-32°F.	SAE 20	MS
Below 30°F.	SAE 10	MS
Chassis Lubricant	PD Co.'s No. 2 Chassis Grease	WB
Wheel Bearings	PD Co.'s Wheel Bearing Grease	WB
Transmission, Steering Gear, Differential	PD Co.'s Hypoid Gear Lube SAE 90	GL-4
Drive Wheel	BZP Co.'s Gear Compound	GC
Hydraulic System	XYZ Co.'s SAE 10 Hydraulic Oil	HO
Torque Convertor	ED Co.'s Torque Fluid	HO
Milling Machines		
General Lubrication	300 SUS @ 100°F. mineral oil	HG
Grease Nipples	No. 2 Calcium base grease	WB
Ball & Roller Bearings	No. 2 Sodium-calcium base grease	WB
Portable Electric Tools		
Bearings	No. 1 Lithium base grease	WB
Reduction gears	No. 2 Lithium base grease	WB
Trucks		
Engine	Supplement 1 Motor Oil	
Above 32°F.	SAE 30	MS
10-32°F.	SAE 20W	MS
−10 to +10	SAE 10W	MS
Transmission, differential, steering gear	GL-4 gear lubricant	GL-4
Chassis Grease Points	No. 1 Calcium Soap Grease	WB
Wheel Bearings	No. 2 Wheel Bearing Grease	WB
Cylinder Grinding Machines		
Hydraulic system Model 5	150 SUS @ 100°F. mineral oil	HO
Model 10	190 SUS @ 100°F. R&O oil	HO
Spindles Model 5	125 SUS @ 100°F. mineral oil	HO
Model 10	160 SUS @ 100°F. R&O oil	HO

TABLE 8

DESCRIPTION OF SYMBOLS

SYMBOL	LUBRICANT DESCRIPTION
GL-4	Multi-purpose gear lubricant: high load capacity; "universal" or multi-purpose; rust, scuff, wear and corrosion resistant; surpassing military specification MIL-L-002105A and recommended for API Service GL-4.
GC	Open gear and wire rope lubricant: extremely adhesive; water resistant; rust preventive.
HG	Tri-purpose hydraulic fluid, machine tool lubricant, and cutting fluid.
HO	Hydraulic fluid: rust and oxidation inhibited hydraulic oil.
MS	Motor oil; multi-grade 10W-30; Supplement 1 quality level.
RL	Track roll lubricant: water resistant; semi-fluid; containing special cohesive compound to reduce leakage and resist washing out action of mud and water.
S-3	Engine oil: very highly detergent; highly dispersant; oxidation and foam inhibited; rust, wear and corrosion preventive. For diesel (and gasoline) engines. Approved Superior Lubricant (Series 3), API Service Designation of DS.
SP	Spindle oil: well refined; stable; low viscosity.
WB	Multi-purpose Grease: NLGI Grade 2; satisfactory for wheel bearing lubrication and general purpose grease application; high dropping point; good oxidation stability; good shear stability; above average load-carrying capacity for a non-EP grease; good high and low temperature properties and pumpability; excellent water resistance.
WL	Mild EP gear oil: high quality mineral oil blended with effective non-corrosive EP agents and lead soap; inhibited against foam; rust preventive.
WY	Way lubricant: compounded, stable, well refined product designed to reduce stick-slip to a minimum.

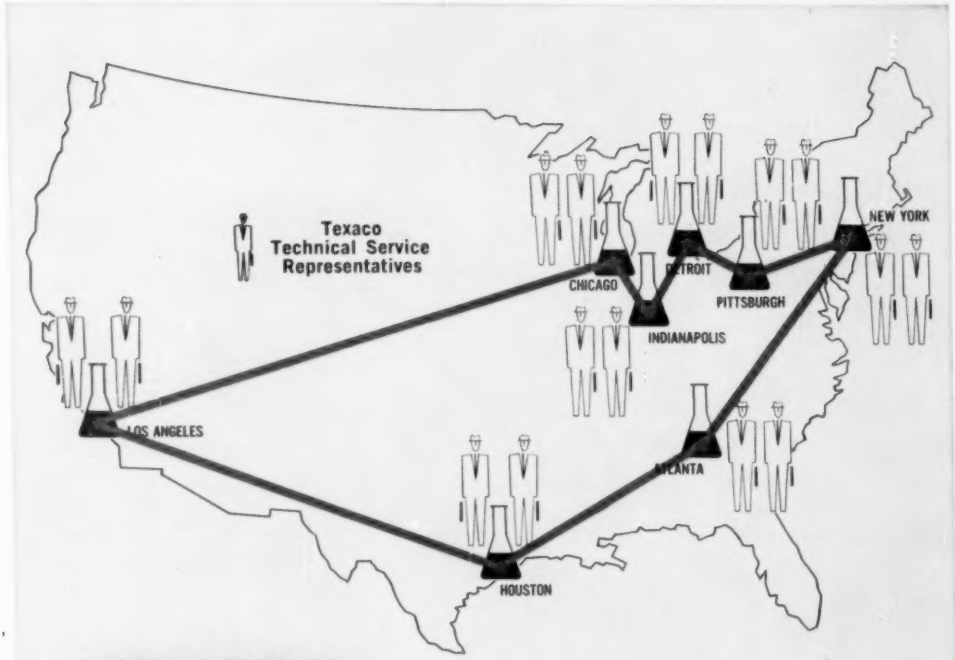
SUMMARY

While lubricant simplification can effect outstanding economies, the importance of an organized lubrication program should not be overlooked. The best lubricant in the world is completely ineffective if it is not applied in the right condition to the right place at the right time and in the right amount. This subject has been thoroughly covered in previous issues[6] of this publication and goes hand in hand with a Simplified Lubrication program.

Simplified Lubrication cuts costs and increases profits by reducing the number of lubricants actually required by a user, decreases the possibility of misapplication with consequent equipment breakdown or operation shutdown, cuts inventory and order costs, increases equipment life and efficiency and reduces capital investment. A qualified lubrication engineer is your best friend and assistant in converting these anticipated savings into profitable realities.

[6] Lubrication Magazine, Sept. 1955, Handling of Lubricants.
Lubrication Magazine, July 1958, Organized Plant Lubrication.
Lubrication Magazine, March 1960, Mobile Lubrication Equipment.

Printed in U.S.A. by
The Georgian Press Inc.
175 Varick Street
New York 14, N. Y.



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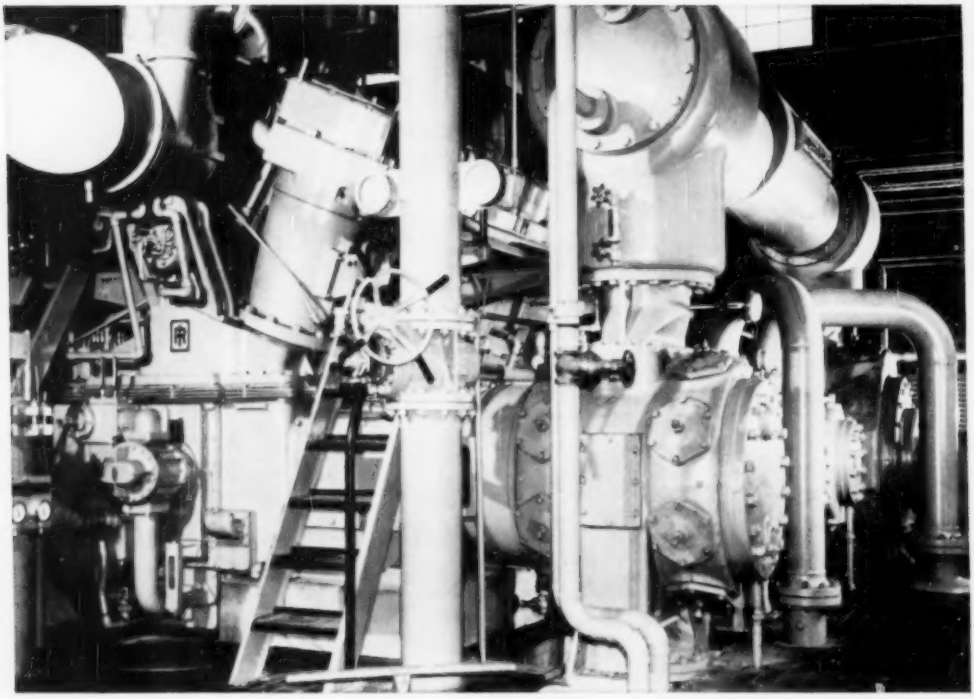

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